

FIG 1

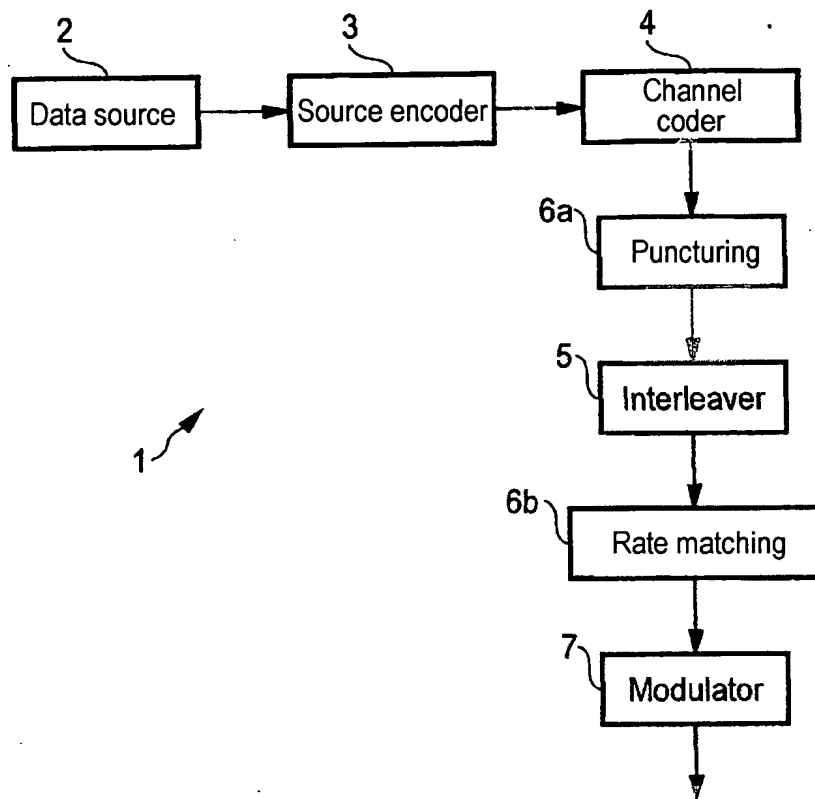


FIG 2

HS-SCCH, Part 2, Pattern 19, FER=1.1×E-02 Error Histogram

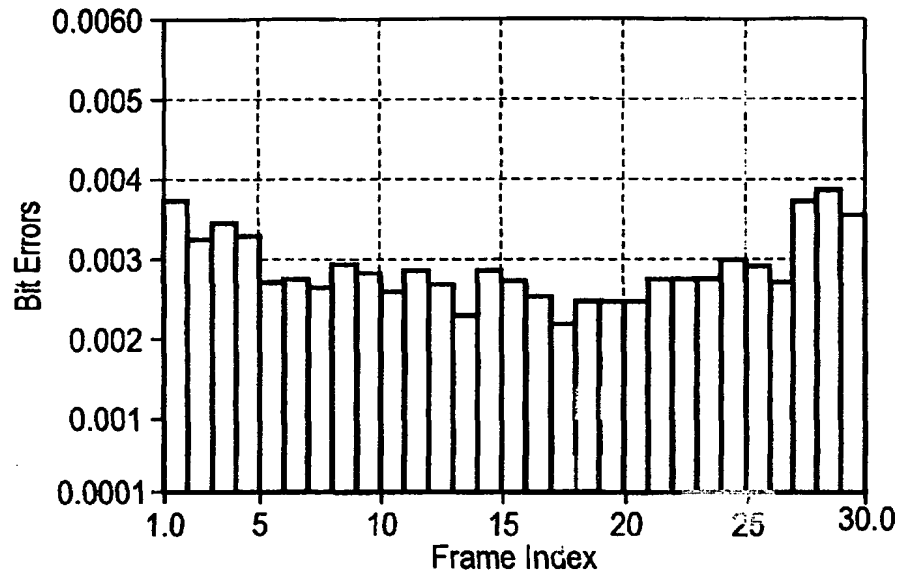


FIG 3

HS-SCCH, Part 2, Pattern 0, FER=1.6×E-02 Error Histogram

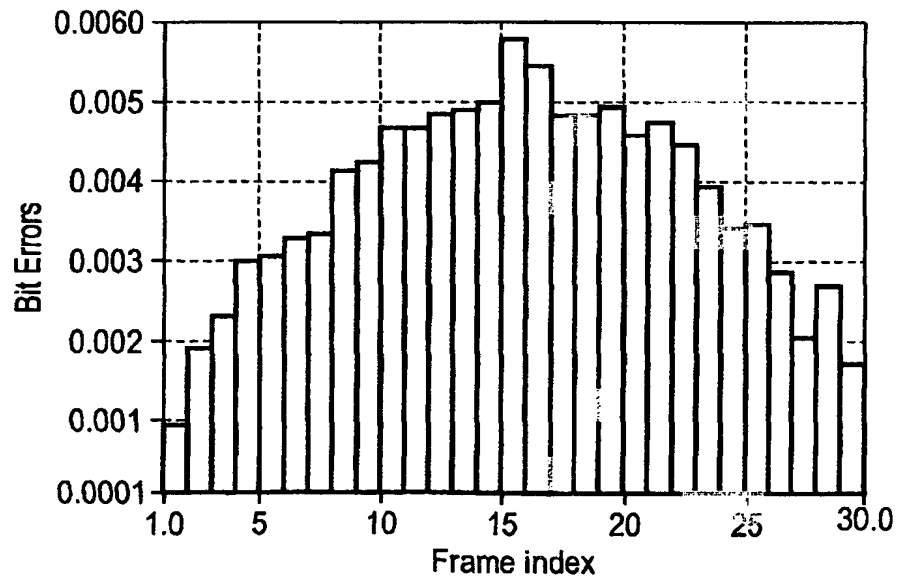


FIG 4

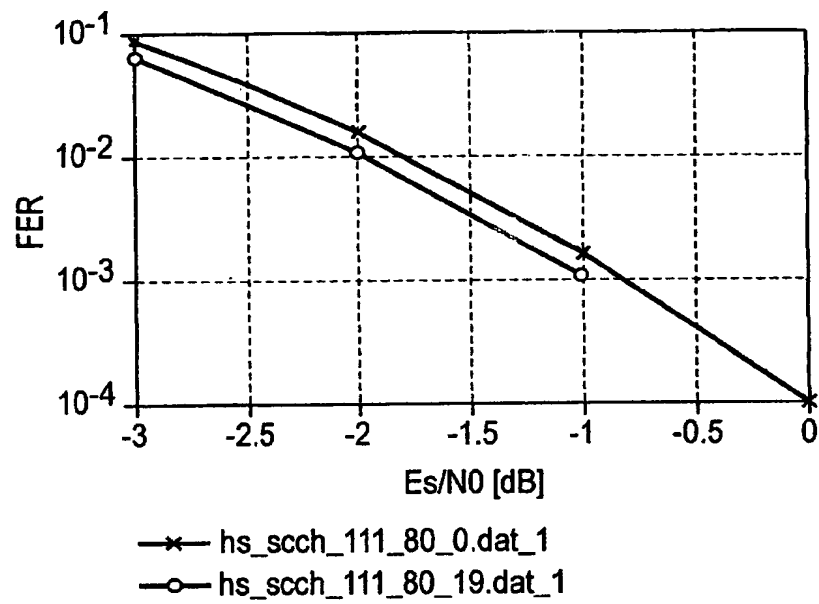
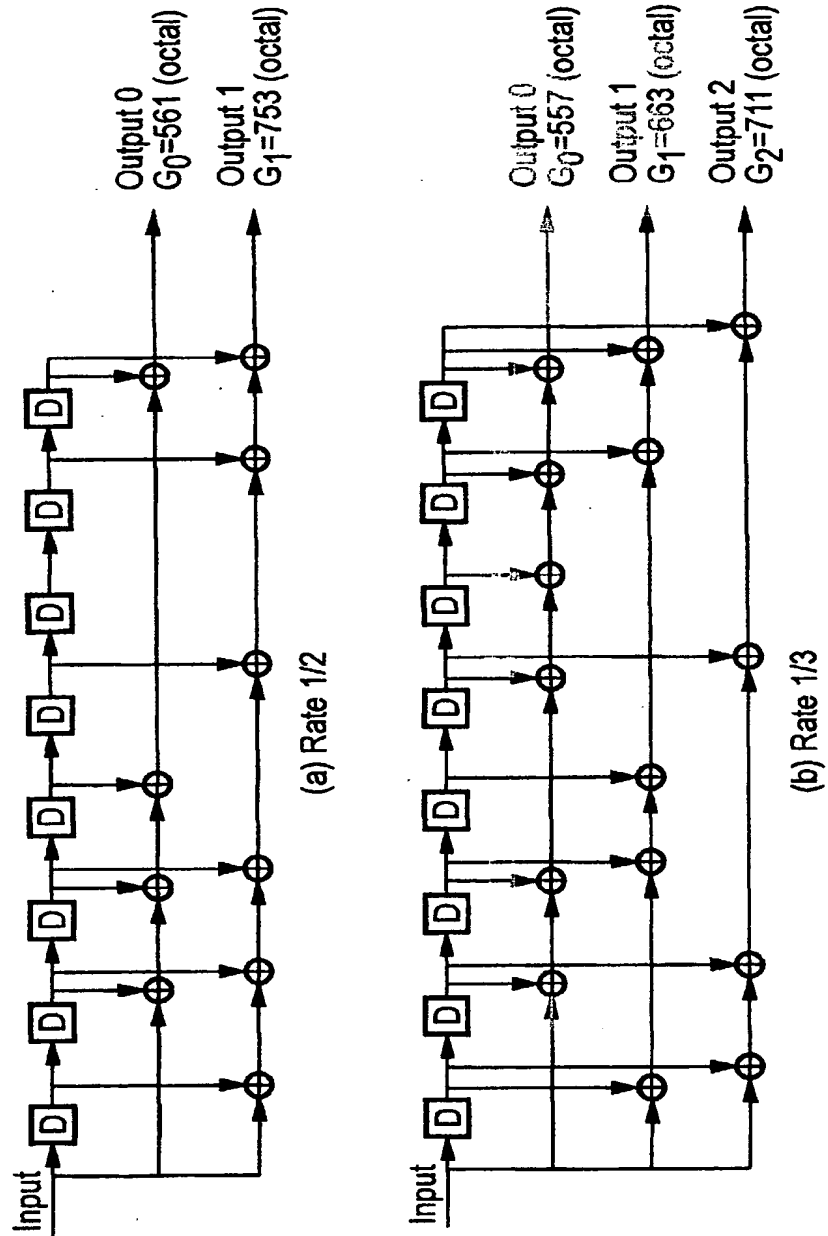


FIG 5



WO 03/085873

PCT/DE03/01061

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FIG 6

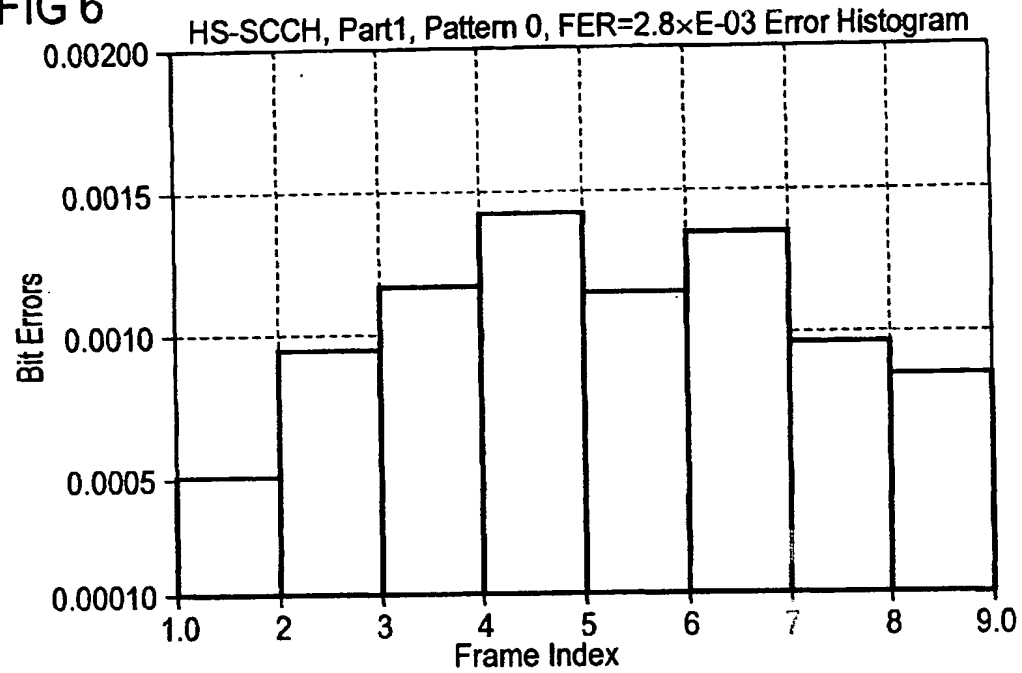


FIG 7

Cumulative puncturing level of the coded bits

| Input Bit | Output 0 | Output 2 |
|-----------|----------|----------|
| 1 | 1 | 1 |
| 2 | 1 | 2 |
| 3 | 2 | 2 |
| 4 | 3 | 3 |
| 5 | 3 | 4 |
| 6 | 4 | 4 |
| 7 | 5 | 4 |
| 8 | 6 | 5 |
| 9 | 7 | 6 |
| n-8 | 7 | 6 |
| n-7 | 6 | 5 |
| n-6 | 6 | 4 |
| n-5 | 5 | 4 |
| n-4 | 4 | 3 |
| n-3 | 4 | 2 |
| n-2 | 3 | 2 |
| n-1 | 2 | 2 |
| n | 1 | 1 |

FIG 8

Information bits concerned

| Input Bit | Output 0 | Output 1 | Output 2 |
|-----------|---------------------------|-----------------------|---------------------------|
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2, 1 | 2, 1 |
| 3 | 3, 1 | 3, 2 | 3, 2, 1 |
| 4 | 4, 2, 1 | 4, 3, 1 | 4, 3, 2, 1 |
| 5 | 5, 3, 2 | 5, 4, 2, 1 | 5, 4, 3, 2, 1 |
| 6 | 6, 4, 3, 1, | 6, 5, 3, 2 | 6, 5, 4, 3, 2, 1 |
| 7 | 7, 5, 4, 2, 1 | 7, 5, 4, 3 | 7, 6, 5, 4, 3, 2, 1 |
| 8 | 8, 6, 5, 3, 2, 1 | 8, 6, 5, 4, 1 | 8, 7, 6, 5, 4, 3, 2, 1 |
| 9 | 9, 7, 6, 4, 3, 2, 1 | 9, 7, 6, 5, 2, 1 | 9, 8, 7, 6, 5, 4, 3, 2, 1 |
| n-8 | 0, -2, -3, -5, -6, -7, -8 | 0, -1, -3, -4, -7, -8 | 0, -1, -2, -5, -8 |
| n-7 | -1, -2, -4, -5, -6, -7 | 0, -2, -3, -6, -7 | 0, -1, -4, -7 |
| n-6 | 0, -1, -3, -4, -5, -6 | -1, -2, -5, -6 | 0, -3, -6 |
| n-5 | 0, -2, -3, -4, -5 | 0, -1, -4, -5 | -2, -5 |
| n-4 | -1, -2, -3, -4, | 0, -3, -4 | -1, -4 |
| n-3 | 0, -1, -2, -3 | -2, -3 | 0, -3 |
| n-2 | 0, -1, -2 | -1, -2 | -2 |
| n-1 | 0, -1 | 0, -1 | -1 |
| n | 0 | 0 | 0 |

FIG 9

Optimized puncturing pattern
Puncturing sequence and cumulative puncturing for max. 18 input bit

| # punct bits | Sequence | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 | 0 | Average value | Av. P rate | Cumulative |
|--------------|----------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|---|---------------|------------|------------|
| 1 | 1 | 1 | | | | | | | | | | | | | | | | | | 1,00 | 0,06 | 1 |
| 2 | k | 1 | | | | | | | | | | | | | | | | | | 1,00 | 0,06 | 2 |
| 3 | 4 | 1 | 1 | | | | | | | | | | | | | | | | | 1,00 | 0,06 | 3 |
| 4 | k-4 | 1 | 1 | 1 | | | | | | | | | | | | | | | | 1,00 | 0,06 | 4 |
| 5 | k-6 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | 1,00 | 0,06 | 5 |
| 6 | 2 | 2 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | 1,20 | 0,07 | 6 |
| 7 | k-1 | 2 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | 1,40 | 0,08 | 7 |
| 8 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | 1,60 | 0,09 | 8 |
| 9 | k-2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | 1,80 | 0,10 | 9 |
| 10 | 8 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | 1,83 | 0,10 | 11 |
| 11 | k-15 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | 1,86 | 0,10 | 13 |
| 12 | k-12 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | | | | | | | | 1,88 | 0,10 | 15 |
| 13 | k-10 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | | | | | | | 1,89 | 0,10 | 17 |
| 14 | 7 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | | | | | | 2,11 | 0,12 | 19 |
| 15 | k-9 | 4 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | | | | | 2,33 | 0,13 | 21 |
| 16 | k-7 | 4 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | | | | 2,56 | 0,14 | 23 |
| 17 | 5 | 5 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | | | 2,78 | 0,15 | 25 |
| 18 | k-4 | 5 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 5 | | 3,00 | 0,17 | 27 |
| 19 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 5 | | 3,22 | 0,18 | 29 |
| 20 | k-5 | 6 | 4 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 6 | | 3,44 | 0,19 | 31 |
| 21 | 15 | 6 | 4 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 6 | | 3,09 | 0,17 | 34 |
| 22 | 12 | 6 | 4 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 6 | | 3,36 | 0,19 | 37 |
| 23 | 14 | 6 | 5 | 5 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 6 | | 3,64 | 0,20 | 40 |
| 24 | k-18 | 6 | 5 | 5 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 7 | | 3,58 | 0,20 | 43 |
| 25 | 11 | 7 | 5 | 5 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 7 | | 3,75 | 0,21 | 45 |
| 26 | k-13 | 7 | 5 | 5 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 8 | | 4,00 | 0,22 | 48 |
| 27 | 10 | 8 | 6 | 6 | 4 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 8 | | 4,25 | 0,24 | 51 |
| 28 | k-8 | 8 | 6 | 6 | 4 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 9 | | 4,50 | 0,25 | 54 |
| 29 | 9 | 9 | 7 | 7 | 4 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 9 | | 4,75 | 0,26 | 57 |

FIG 10

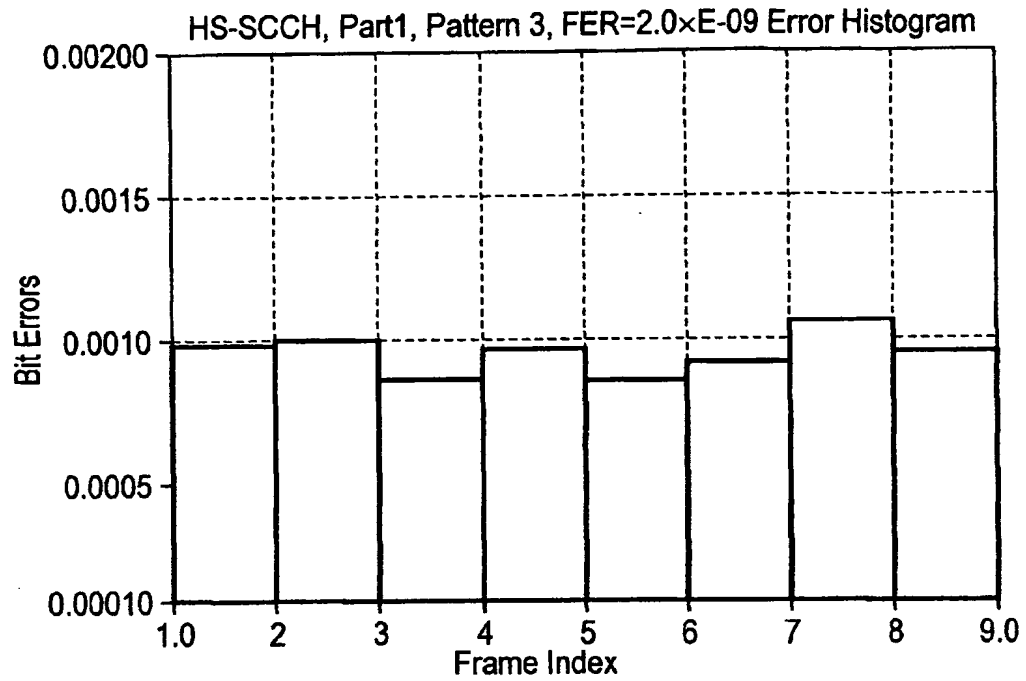


FIG 11

| Puncturing from 48 to 40 bits, R =1/3 | |
|---------------------------------------|-----------------------------|
| | Bits to be punctured |
| 1 | 1, 2, 3, 4, 45, 46, 47, 48 |
| 2 | 1, 2, 3, 4, 42, 45, 47, 48 |
| 3 | 1, 2, 4, 8, 42, 45, 47, 48 |
| 4 | 1, 2, 4, 15, 42, 45, 47, 48 |

FIG 12A

| Puncturing from 111 to 80 bits, R=1/3 | |
|---------------------------------------|--|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 24, 92, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111 |
| 2 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 24, 92, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111 |
| 3 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 48, 60, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111 |
| 4 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 48, 60, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111 |
| 5 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 42, 45, 57, 66, 93, 96, 98, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 6 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 42, 45, 57, 66, 93, 96, 98, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 7 | 1, 2, 3, 4, 7, 8, 9, 15, 21, 27, 33, 39, 45, 51, 57, 63, 69, 75, 81, 87, 93, 96, 99, 101, 102, 104, 105, 108, 109, 110, 111 |
| 8 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 24, 36, 48, 60, 72, 84, 93, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 9 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 24, 36, 48, 60, 72, 84, 93, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 10 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 27, 39, 51, 63, 75, 87, 93, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 11 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 27, 39, 51, 63, 75, 87, 93, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 12 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 45, 48, 57, 63, 93, 96, 98, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 13 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 45, 48, 57, 63, 93, 96, 98, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 14 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 24, 36, 48, 54, 60, 72, 84, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 15 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 24, 36, 48, 54, 60, 72, 84, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 16 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 45, 48, 51, 57, 63, 93, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |

FIG 12B

| | |
|----|--|
| 17 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 45, 48, 51, 57, 63, 93, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 18 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 36, 48, 54, 57, 60, 72, 84, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 19 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 14, 15, 24, 36, 42, 48, 54, 57, 60, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 20 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 36, 42, 48, 54, 57, 60, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 21 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 14, 15, 36, 42, 45, 48, 54, 57, 60, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 22 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 36, 42, 45, 48, 54, 57, 60, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 23 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 36, 42, 48, 51, 57, 60, 66, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 24 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 36, 48, 54, 57, 60, 66, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 25 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 14, 15, 24, 48, 54, 57, 60, 63, 66, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 26 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 48, 54, 57, 60, 63, 66, 72, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 27 | 1, 2, 3, 4, 5, 6, 7, 8, 13, 15, 24, 36, 42, 48, 51, 57, 60, 66, 72, 92, 96, 99, 101, 102, 104, 105, 107, 108, 109, 110, 111 |
| 28 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 48, 54, 57, 60, 66, 69, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 29 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 24, 92, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111 |
| 30 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 24, 92, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111 |
| 31 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 45, 48, 57, 66, 93, 96, 98, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 32 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 45, 48, 57, 66, 93, 96, 98, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |
| 33 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 14, 15, 24, 42, 48, 54, 57, 60, 66, 69, 96, 99, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111 |

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FIG 13

| Repetition of 8 bits (32 to 40 bits), $=1/2$ | |
|--|--------------------------------|
| Pattern | Bits to be repeated |
| 1 | 17, 19, 21, 23, 25, 27, 29, 31 |
| 2 | 13, 14, 15, 16, 17, 18, 19, 20 |
| 3 | 18, 20, 22, 24, 26, 28, 30, 32 |
| 2 | 16, 18, 20, 22, 24, 26, 28, 30 |

FIG 14

| Repetition of 6 bits (74 to 80 bits), $R=1/2$ | |
|---|------------------------|
| Pattern | Bits to be repeated |
| 1 | 35, 36, 37, 38, 39, 40 |
| 2 | 32, 34, 36, 38, 40, 42 |
| 3 | 26, 30, 34, 38, 42, 44 |
| 4 | 20, 28, 36, 44, 52, 60 |

FIG 15

| Repetition of 4 bits (36 to 40 bits), $R=1/2$ | |
|---|---------------------|
| Pattern | Bits to be repeated |
| 1 | 16, 18, 20, 22 |
| 2 | 14, 18, 20, 22 |

FIG 16

| Repetition of 14 bits (54 to 40 bits), $R=1/3$ | |
|--|--|
| Pattern | Bits to be repeated |
| 1 | 1, 2, 3, 4, 7, 8, 39, 42, 45, 48, 51, 52, 53, 54 |
| 2 | 1, 2, 3, 4, 6, 7, 8, 39, 42, 48, 51, 52, 53, 54 |
| 3 | 1, 2, 3, 4, 7, 8, 36, 39, 42, 48, 51, 52, 53, 54 |
| 4 | 1, 2, 3, 4, 6, 7, 8, 39, 45, 48, 51, 52, 53, 54 |

| Additional puncturing pattern from 111 to 80 bits, R=1/3 | | /3 |
|--|---|----|
| Pattern | Bits to be punctured | |
| 34 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 44, 49, 54, 59, 64, 69 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 35 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 47, 52, 57, 62, 67, 72, 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 36 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 44, 49, 54, 59, 64, 69 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 37 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 43, 47, 57, 61, 65, 69, 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 38 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 39, 42, 44, 49, 54, 59, 64, 69 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 39 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 36, 39, 44, 49, 54, 59, 64, 69 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 40 | 1, 2, 3, 4, 5, 7, 8, 13, 15, 24, 30, 35, 40, 45, 50, 55, 60, 68, 70, 75, 83, 96, 99, 101, 102, 104, 106, 108, 109, 110, 111 | |
| 41 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 45, 51, 57, 63, 69, 75, 92, 96, 99, 101, 102, 104, 106, 107, 108, 109, 110, 111 | |
| 42 | 1, 2, 3, 4, 5, 7, 8, 12, 13, 15, 24, 36, 41, 46, 51, 56, 61, 66, 71, 76, 92, 96, 99, 101, 102, 104, 106, 108, 109, 110, 111 | |

Fig.17

| Puncturing from 108 to 80 bits, R=1/3 | |
|---------------------------------------|--|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 48, 54, 57, 63, 66, 69, 72, 75, 93, 96, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108 |

5 Fig.18

Puncturing pattern 114->80, R=1/3

| Puncturing from 114 to 80 bits, R=1/3 | |
|---------------------------------------|--|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 45, 48, 54, 57, 60, 66, 69, 72, 75, 99, 102, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114 |
| 2 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 48, 54, 57, 60, 66, 69, 72, 96, 99, 102, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114 |
| 3 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 15, 21, 24, 48, 54, 57, 60, 63, 66, 96, 97, 99, 102, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114 |
| 4 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 48, 54, 57, 60, 66, 69, 72, 75, 96, 99, 102, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114 |
| 5 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 45, 48, 54, 57, 60, 66, 69, 72, 75, 96, 99, 102, 104, 105, 107, 108, 110, 111, 112, 113, 114 |
| 6 | 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 24, 42, 48, 54, 57, 60, 66, 69, 72, 75, 96, 99, 102, 104, 105, 107, 108, 110, 111, 112, 113, 114 |
| 7 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 15, 24, 48, 54, 57, 60, 66, 69, 96, 99, 101, 102, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114 |

5

Fig.19

Puncturing pattern 117 -> 80, R=1/3

| Puncturing pattern from 117 to 80 bits, R = 1/3 | |
|---|---|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 2 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 3 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 40, 44, 51, 52, 56, 63, 64, 68, 75, 76, 80, 87, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 4 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 43, 47, 51, 55, 59, 63, 67, 71, 75, 79, 83, 87, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 5 | 1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 18, 23, 28, 33, 38, 43, 48, 53, 58, 63, 68, 73, 78, 83, 88, 93, 98, 105, 106, 109, 110, 111, 113, 114, 115, 116, 117 |
| 6 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 40, 43, 46, 49, 55, 61, 64, 67, 70, 73, 76, 79, 82, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 7 | 1, 2, 3, 4, 5, 7, 8, 12, 13, 15, 20, 24, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 87 98, 102, 105, 107, 108, 110, 112, 114, 115, 116, 117 |
| 8 | 1, 2, 3, 4, 5, 7, 8, 12, 13, 15, 24, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 86 98, 102, 105, 107, 108, 110, 112, 114, 115, 116, 117 |
| 9 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72, 75, 78, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 10 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 42, 45, 48, 54, 60, 63, 66, 69, 72, 75, 78, 81, |

| | |
|----|---|
| | 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 11 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 42, 45, 48, 51, 54, 57, 60, 69, 75, 78, 81, 84, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 12 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 42, 45, 48, 54, 57, 60, 63, 66, 69, 72, 75, 78, 81, 102, 105, 107, 108, 110, 111, 112, 113, 114, 115, 116, 117 |
| 13 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 42, 45, 48, 54, 60, 63, 66, 69, 72, 75, 78, 81, 84 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |
| 14 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 39, 42, 45, 48, 54, 60, 63, 66, 69, 72, 75, 78, 81, 99, 102, 105, 107, 108, 110, 111, 113, 114, 115, 116, 117 |
| 15 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 24, 36, 42, 45, 48, 54, 60, 63, 66, 69, 72, 75, 78, 81, 98, 102, 105, 107, 108, 110, 112, 113, 114, 115, 116, 117 |

Fig. 20

Puncturing pattern 52 -> 40, $R=1/2$

| Puncturing from 52 to 40 bits, $R = 1/2$ | |
|--|--|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 5, 43, 45, 47, 49, 50, 51, 52 |
| 2 | 1, 2, 3, 4, 5, 45, 47, 48, 49, 50, 51, 52 |
| 3 | 1, 2, 3, 4, 15, 25, 45, 47, 49, 50, 51, 52 |
| 4 | 1, 2, 3, 4, 5, 43, 47, 48, 49, 50, 51, 52 |
| 5 | 1, 2, 3, 4, 5, 43, 45, 48, 49, 50, 51, 52 |
| 6 | 1, 2, 3, 4, 5, 25, 45, 47, 48, 49, 51, 52 |
| 7 | 1, 2, 3, 4, 5, 25, 43, 47, 48, 49, 51, 52 |
| 8 | 1, 2, 3, 4, 5, 43, 45, 47, 48, 49, 51, 52 |
| 9 | 1, 2, 3, 4, 15, 43, 45, 47, 48, 49, 51, 52 |

5

Fig.21

Puncturing pattern 46 -> 40, $R=1/2$

| Puncturing from 46 to 40 bits, $R = 1/2$ | |
|--|----------------------|
| Pattern | Bits to be punctured |
| 1 | 1, 3, 39, 41, 45, 46 |
| 2 | 1, 3, 39, 41, 43, 46 |
| 3 | 1, 3, 39, 43, 45, 46 |
| 4 | 1, 2, 3, 43, 45, 46 |
| 5 | 1, 2, 39, 41, 45, 46 |
| 6 | 1, 2, 3, 39, 43, 46 |

10

Fig.22

Puncturing pattern 54 -> 40, R=1/3

| Puncturing from 54 to 40 bits, R=1/3 | |
|--------------------------------------|--|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 6, 7, 8, 39, 42, 48, 51, 52, 53, 54 |
| 2 | 1, 2, 3, 4, 6, 7, 8, 39, 45, 48, 51, 52, 53, 54 |
| 3 | 1, 2, 3, 4, 7, 8, 39, 42, 45, 48, 51, 52, 53, 54 |
| 4 | 1, 2, 3, 4, 7, 8, 13, 39, 45, 48, 51, 52, 53, 54 |
| 5 | 1, 2, 3, 4, 7, 8, 36, 39, 42, 48, 51, 52, 53, 54 |

5

Fig.23

Puncturing pattern 56 -> 40, R= 1/2

10

| Puncturing from 56 to 40 bits, R = 1/2 | |
|--|---|
| Pattern | Bits to be punctured |
| 1 | 1, 2, 3, 4, 5, 6, 7, 45, 47, 49, 51, 52, 53, 54, 55, 56 |
| 2 | 1, 2, 3, 4, 5, 6, 15, 45, 47, 49, 51, 52, 53, 54, 55, 56 |
| 3 | 1, 2, 3, 4, 5, 15, 21, 29, 47, 49, 51, 52, 53, 54, 55, 56 |

Fig.24

Repetition pattern 36 -> 40 bits, $R=1/2$

| Repetition of 36 to 40 bits, $R=1/2$ | |
|--------------------------------------|---------------------|
| Pattern | Bits to be repeated |
| 1 | 14, 18, 20, 22 |
| 2 | 16, 18, 20, 22 |
| 3 | 14, 17, 10, 23 |
| 4 | 10, 15, 20, 25 |
| 5 | 13, 16, 19, 22 |

5

Fig.25

| Puncturing of 48 to 40 bits | |
|-----------------------------|------------------------------|
| Pattern | Bits to be punctured |
| 1 | 1, 8, 15, 22, 28, 35, 42, 48 |
| 2 | 1, 2, 10, 18, 25, 33, 41, 48 |
| 3 | 1, 2, 3, 12, 21, 30, 39, 48 |
| 4 | 1, 2, 3, 4, 15, 26, 37, 48 |
| 5 | 1, 2, 3, 4, 5, 20, 34, 48 |
| 6 | 1, 2, 3, 4, 5, 6, 27, 48 |

Fig. 26

| Figure 27: Puncturing of 111 to 80 bits | |
|---|---|
| Pattern | Bits to be punctured |
| 1 | 1, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47, 50, 53, 56, 60, 63, 66, 69, 72, 75, 78, 81, 84, 87, 90, 93, 96, 99, 102, 105, 108, 111 |
| 2 | 1, 2, 6, 9, 12, 15, 18, 21, 24, 27, 31, 34, 37, 40, 43, 46, 49, 52, 55, 59, 62, 65, 68, 71, 74, 77, 80, 83, 87, 90, 93, 96, 99, 102, 105, 108, 111 |
| 3 | 1, 2, 3, 7, 10, 13, 16, 19, 23, 26, 29, 32, 35, 38, 42, 45, 48, 51, 54, 57, 61, 64, 67, 70, 73, 77, 80, 83, 86, 89, 92, 96, 99, 102, 105, 108, 111 |
| 4 | 1, 2, 3, 4, 8, 11, 14, 17, 21, 24, 27, 30, 34, 37, 40, 43, 47, 50, 53, 56, 60, 63, 66, 69, 73, 76, 79, 82, 86, 89, 92, 95, 99, 102, 105, 108, 111 |
| 5 | 1, 2, 3, 4, 5, 9, 12, 15, 19, 22, 25, 29, 32, 35, 39, 42, 45, 49, 52, 55, 58, 62, 65, 68, 72, 75, 78, 82, 85, 88, 92, 95, 98, 102, 105, 108, 111 |
| 6 | 1, 2, 3, 4, 5, 6, 10, 13, 17, 20, 23, 27, 30, 34, 37, 40, 44, 47, 51, 54, 57, 61, 64, 67, 71, 74, 78, 81, 84, 88, 91, 95, 98, 101, 105, 108, 111 |
| 7 | 1, 2, 3, 4, 5, 6, 7, 11, 14, 18, 21, 25, 28, 32, 35, 39, 42, 46, 49, 53, 56, 59, 63, 66, 70, 73, 77, 80, 84, 87, 91, 94, 98, 101, 105, 108, 111 |
| 8 | 1, 2, 3, 4, 5, 6, 7, 8, 12, 16, 19, 23, 26, 30, 33, 37, 40, 44, 48, 51, 55, 58, 62, 65, 69, 72, 76, 80, 83, 87, 90, 94, 97, 101, 104, 108, 111 |
| 9 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 17, 20, 24, 28, 31, 35, 39, 42, 46, 50, 53, 57, 60, 64, 68, 71, 75, 79, 82, 86, 90, 93, 97, 101, 104, 108, 111 |
| 10 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 18, 22, 25, 29, 33, 37, 40, 44, 48, 52, 55, 59, 63, 67, 70, 74, 78, 82, 85, 89, 93, 97, 100, 104, 108, 111 |
| 11 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 19, 23, 27, 31, 35, 38, 42, 46, 50, 54, 58, 61, 65, 69, 73, 77, 81, 85, 88, 92, 96, 100, 104, 108, 111 |

```

if puncturing is to be performed
5   e = eini                -- initial error between current and desired puncturing ratio
   m = 1                    -- index of current bit
   do while m <= Xi
       e = e - eminus        -- update error
       if e <= 0 then        -- check if bit number m should be punctured
10          set bit xi,m to δ where δ ∈ {0, 1}
          e = e + eplus -- update error
       end if
       m = m + 1             -- next bit
   end do
15  else
       e = eini                -- initial error between current and desired puncturing ratio
       m = 1                    -- index of current bit
       do while m <= Xi
           e = e - eminus        -- update error
           do while e <= 0        -- check if bit number m should be repeated
20              repeat bit xi,m
              e = e + eplus      -- update error
           end do
           m = m + 1             -- next bit
25       end do
   end if

```

Fig. 28